SEAMAP Survey Information Template

Agency:
National Marine Fisheries Service

Name of Survey:
SEAMAP Spring Plankton Survey

Cost of Survey, Source(s) and Amount(s) of Specific Funding: Please provide the total cost of this survey, including details on the specific sources of funding that support this survey (SEAMAP, State, Federal) and how much funding is provided by each source.
Information provided elsewhere

General Geographic Area Surveyed: Provide information on the general area sampled, such as inshore, nearshore, EEZ, other.

This survey samples the open Gulf of Mexico (GOM) from the edge of the U.S. continental shelf to the extent of the Exclusive Economic Zone.

Latitude/Longitude of Sampling Area: Provide the range of latitude/longitude of sampling area, if known. Provide maps of sampling stations.

Longitudinal range of sampling is 97.00 to 83.00 degrees west, and latitudinal range is 30.50 to 23.50 degrees north. The distribution of standard sampling stations from the survey is shown below.

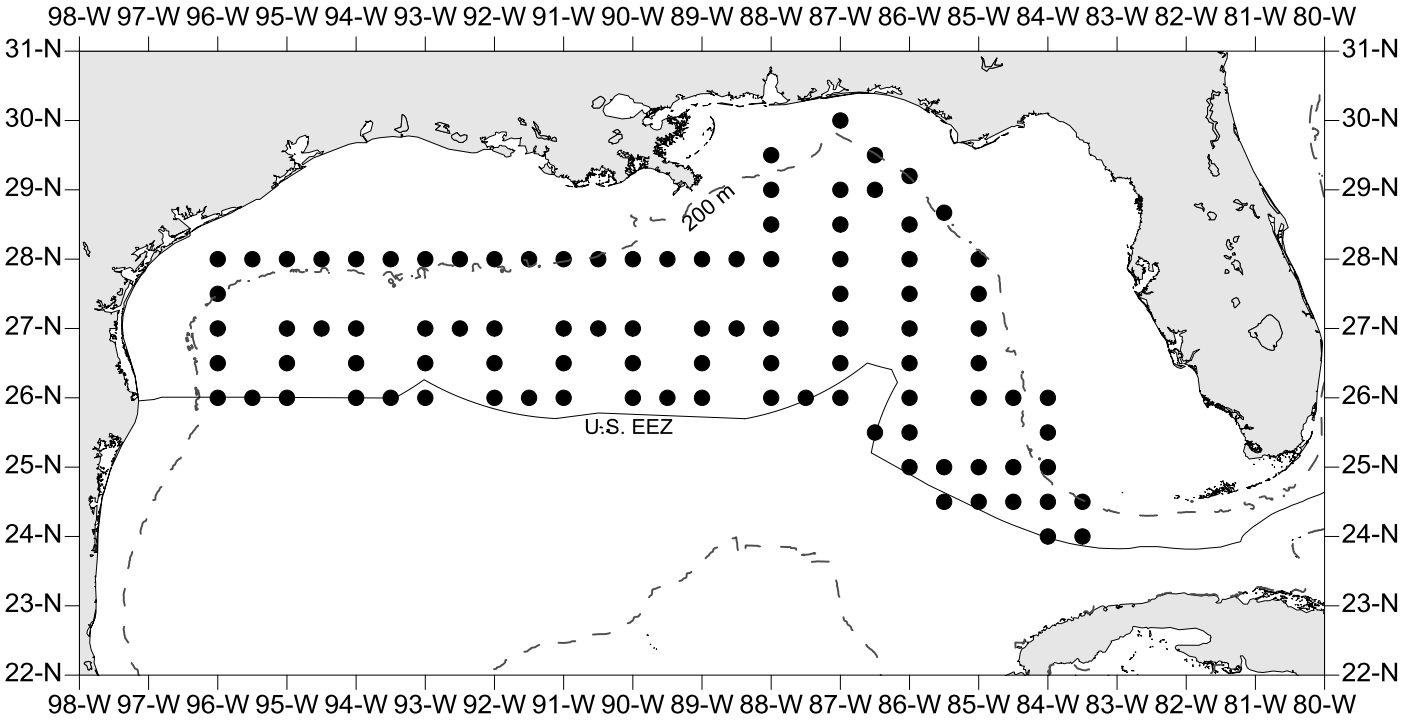

Figure 1. Standard SEAMAP Spring Plankton Survey sampling stations.

Dates of Survey: List specific dates of survey for 2009 or general dates if it varies annually.

The survey has been conducted annually since 1982 (with the exception of 1985), primarily from April to late May or early June.

Objectives: List goals and objectives of the survey.

Assess the occurrence, abundance and geographic distribution of the early life stages of spring spawning fishes, especially bluefin tuna (*Thunnus thynnus*); decapod crustacean larvae and major taxa of invertebrate zooplankton.

Obtain *in situ* physical oceanographic and environmental data to describe the pelagic habitat of fish eggs and larvae; decapod crustacean larvae and major taxa of invertebrate zooplankton.

Sampling Gear: Describe the sampling gear.

Primary biological sampling is done using SEAMAP 61 cm bongo and 1 x 2 m neuston nets. Bongo frame is fitted with 0.335 mm mesh nets and the neuston frame with 0.947 mm mesh nets.

Conductivity, temperature and depth profilers (CTDs) optionally equipped with a dissolved oxygen sensor, transmissometer (turbidity) and fluorometer are used to gather environmental data throughout the water column.

Hydrographic bottle casts are used to obtain replicate water samples from the surface, mid and/or maximum chlorophyll layer and near bottom or to a maximum depth of 200 m.

A flow-through thermosalinograph system equipped with a fluorometer is used to obtain along-track near-surface measurements while the vessel is underway.

A Turner Designs 10-AU-005 benchtop fluorometer with a 10-040R optical kit is used to analyze chlorophyll a samples.

A Continuous Underway Fish Egg Sampler (CUFES) is used to collect along-track plankton samples at regular intervals.

A 1 x 1 m Multiple Opening and Closing Net Environmental Sensing System (MOCNESS) is used to collect plankton samples from discreet depths to assess the vertical distributions of invertebrate zooplankton, fish eggs and larvae. The MOCNESS is fitted with nine 0.505 mm mesh nets.

A Methot juvenile fish trawl is used to collect of larval and juvenile fishes under-represented in bongo and/or neuston nets. The Methot frame (2.32 x 2.24 m) is fitted with a 14.3 m long, 3 mm mesh net.

Targeted Species: Provide the major species targeted by the survey.

The survey targets all spring spawning fishes with pelagic larvae, especially bluefin tuna (*Thunnus thynnus*).

Target Habitat: Provide the habitat targeted by the survey, if applicable.

The survey targets the pelagic habitat of fish eggs and larvae, decapod crustacean larvae and major taxa of invertebrate zooplankton at the surface interface with neuston collections, and throughout the water column (from the surface to near bottom or a maximum depth of 200 m) with bongo collections.

CUFES sampling targets near surface concentrations of invertebrate zooplankton and fish eggs.

MOCNESS sampling targets invertebrate zooplankton, fish eggs and larvae at discreet depths in the water column.

Methot sampling targets post-larval and juvenile fishes that are not effectively captured in bongo, neuston and MOCNESS samples.

Site Selection Methods: Explain the method for selecting sampling locations, such as stratified random, random sampling, transects, etc.

Plankton sampling is conducted at predetermined stations arranged in a fixed, systematic grid. Most grid locations, or SEAMAP stations (designated by a unique SEAMAP or 'B' number), are located at <56 km or 0.5 degree intervals. See Figure 1.

Sampling Methods: Provide any additional specific information on sampling methods, such as soak time, trawl times, etc.

Ichthyoplankton sample and data collection were implemented in accordance with procedures outlined in the SEAMAP data collections manual. Primary sampling gear consisted of a CTD profile, a neuston tow and at every other station a bongo tow with attached (on towing cable above the frame) SEACAT profiler. Bongo samples were taken with the standard SEAMAP 61 cm bongo outfitted with two 0.335 mm mesh nets and towed in an oblique path from near bottom or 200 m maximum depth to the surface. Vessel speed was adjusted during the bongo tow to maintain a 45-degree wire angle in order to uniformly sample the water column. Real-time water temperature, salinity and depth data were monitored and recorded during each bongo tow. Flowmeters were mounted inside the bongo nets to measure the volume of water filtered during tows. Neuston samples were taken using a 0.947 mm mesh net attached to a 1 x 2 m metal frame that was towed for 10 minutes at a vessel speed (~ 2 knots) sufficient to keep the net opening half submerged in the water and thus maintaining a sampling depth of 0.5 m. Tows were shortened to no less than 5 minutes if algae (*e.g. Sargassum* sp.) began to accumulate in the net and make retrieval onto the deck difficult. Right bongo samples were initially preserved in 10% formalin and transferred to 95% ethanol (EtOH) after 36 hours. Left bongo and neuston samples were initially preserved in 95% EtOH and transferred to fresh EtOH after 24 hours.

Environmental data were collected at each station in accordance with procedures outlined in the SEAMAP data collections manual. CTD casts were made to near bottom or a maximum depth of 200 m. Environmental data were collected with a Seabird SBE 9/11 Plus CTD equipped with a temperature, conductivity, dissolved oxygen, and digiquartz pressure sensor, as well as a fluorometer and transmissometer. Information from shipboard sensors was accessed via the Scientific Computer System (SCS), which continuously displayed and recorded wind direction, wind speed, barometric pressure, sea surface temperature, air temperature, water depth, and the ship's position, heading and speed. Water samples were taken using Niskin bottles attached to a carousel sampler at the surface, midwater or chlorophyll maximum layer, and near-bottom (up to 200 m maximum) for bench top fluorometer analysis using a modified Welshmeyer method. The modified fluorometric procedure used a Turner Designs 10-AU-005 benchtop fluorometer with a 10-040R optical kit to determine chlorophyll *a* levels.

The CUFES system included a submersible pump, concentrator, and sample collector. Water was pumped from the ship's sea chest located ~4 m below the surface to the concentrator at a calibrated flow rate. The sample was then concentrated through a 0.505 mm mesh filter. Samples were taken approximately every 30 minutes while the ship was underway between stations. All samples were preserved in 95% EtOH. Environmental data collected during CUFES sampling included surface temperature, salinity and fluorescence from the ships thermosalinograph that was logged continuously for the 30 minute sample.

During MOCNESS tows, water temperature and salinity, and net depth, angle and volume filtered were continually monitored using an onboard sensor package. Net 1 was towed obliquely from the surface to a predetermined maximum depth. Nets 2 through 9 were towed obliquely through discrete depth ranges. Winch and ship speed were maintained at rates that result in a filtered water volume of ~250 m^3 for nets 2 through 9. Samples from net 1 were preserved in 10% formalin and transferred to 95% EtOH after at least 36 hours. The remaining samples (nets 2-9) were initially preserved in 95% EtOH and transferred to fresh EtOH after 24 hours.

The Methot was fished either horizontally through the water column at a fixed depth, or in a stepped oblique manner from a maximum depth to the surface. A flow meter mounted inside the net measured water volume filtered during the tow. Depth of tow was monitored with a time, depth recorder (TDR) or a SIMRAD temperature-depth sensor. Samples were preserved in 95 % EtOH or 10% formalin depending of the amount of gelatinous organisms present. Samples were transferred to fresh 95% EtOH after 24 hrs if initially preserved in EtOH, or after 36 hrs if initially preserved in formalin.

Data Collected: Provide a list of biological, environmental, habitat, and any other data collected consistently on the survey.

Station information included date, time zone, start/end time of sampling, start/end water depth of sampling, ship's speed, wind speed, wind direction, sea state, barometric pressure, sea surface temperature and air temperature.

Plankton samples contained invertebrate zooplankton, fish eggs and larvae. The presence/absence and/or number of jellyfish were recorded for each plankton sample. Likewise, the presence/absence and the amount of *Sargassum* sp. were recorded for each plankton sample.

Water column profiles included salinity, temperature, depth, dissolved oxygen, turbidity, and fluorescence data.

Chlorophyll *a* values were measured in water samples taken at the surface, mid or chlorophyll maximum layer, and maximum water depths.

Visual observations including cloud cover, amount of precipitation and water color were also recorded.

<u>Deviations from SEAMAP Protocols</u>: Provide details on any deviations from approved SEAMAP sampling protocols.

Detailed information (identification, size and volume) was taken on select taxa of gelatinous zooplankton collected in bongo and neuston net samples. The amount of *Sargassum* sp. present was recorded for each plankton sample.

Plankton collections with MOCNESS and Methot nets were done as time permitted, to supplement the information gathered with the standard SEAMAP gear.

Samples were taken with the CUFES system during transits between SEAMAP stations.

The analysis of chlorophyll *a* using bench-top fluorometry was also in addition to the SEAMAP requirements.

<u>Logistical Challenges</u>: If there are any specific logistical challenges that influence your survey methods please explain.

No logistical challenges documented at this time.

<u>Use of Data</u>: Please provide specific details on the use of all data collected during this survey, including use in stock assessments and management activities.

The ichthyoplankton data and specimens generated by these surveys have been used to develop identification guides for the early life stages of fishes; infer spawning seasonality of adult fish populations; provide an alternate means of predicting/identifying locations of fish spawning habitat; identify 'sources' and 'sinks' of larval recruits; and quantify the impact of entrainment mortality by liquefied natural gas facilities (LNG); provide historical data for input into models estimating the impact of the Deepwater Horizon oil spill event in 2010; characterize the distribution, occurrence and abundance of decapod crustacean larvae and major taxa of invertebrate zooplankton.

Fishery-independent larval indices of abundance have been developed from the survey time-series for bluefin tuna (*Thunnus thynnus*), and are incorporated into the latest stock assessment models. The bluefin tuna larval index is the sole fishery-independent index for the GOM.

<u>Data Gaps</u>: Please provide information on any gaps in the data collected by this survey, including an explanation of why data gaps exist and potential methods to fill data gaps.

International boundaries limit the survey to open GOM waters within the U.S. Exclusive Economic Zone.

<u>Future Modifications</u>: Please explain any proposed future modifications to this survey.

Future modifications to the survey should focus on increasing the number of samples collected, cooperative work with Mexico to expand coverage into the southern GOM and adaptive sampling techniques to better define the pelagic habitat of bluefin tuna and other species.